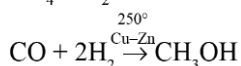
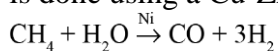


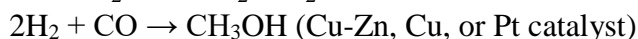
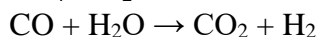
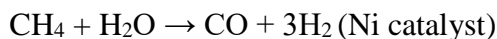
ANSWERS: Fermentation

1. Methanol is made from methane in a two (or three) step process.

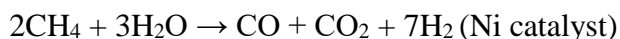
The first reaction is done at high temperatures (over 800°C) using a nickel catalyst, while the last reaction is done using a Cu-Zn / Cu / Pt catalyst.



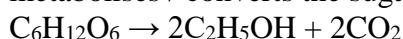
OR



OR



Ethanol is made by a process of fermentation, which involves the conversion of a solution of sugar molecules (in water) into ethanol and carbon dioxide in warm, anaerobic conditions using yeast as a catalyst. Yeast is a living organism and requires warmth and moisture to carry out fermentation. Yeast metabolises / converts the sugars into alcohol when there is a lack of oxygen.



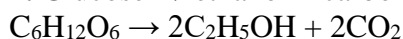
How do they differ?

The production of ethanol is a one-step process, whereas the production of methanol involves more than one step.

They both involve the use of catalysts, but to produce ethanol it is yeast, a living organism. To produce methanol, a metal (non-living) catalysts is used.

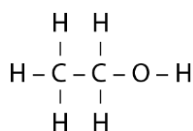
The production of methanol requires high temperatures, but for ethanol it requires warm and anaerobic conditions.

2. Glucose \rightarrow ethanol + carbon dioxide



Fermentation involves the conversion of a solution of sugar molecules (in water) into ethanol and carbon dioxide in warm, anaerobic conditions using yeast as a catalyst. Yeast is a living organism and requires warmth (and moisture) to carry out fermentation. Yeast metabolises / converts the sugars to alcohol when there is a lack of oxygen / via anaerobic respiration.

3. Fermentation involves the conversion of a solution of sugar molecules (in water) into ethanol and carbon dioxide in **warm, anaerobic** conditions using **yeast** as a **catalyst**. Yeast is a living organism and requires warmth and moisture to carry out life processes. Yeast metabolises / converts the sugars to alcohol when it is starved of oxygen. The yeast dies when the alcohol levels become too high.



4. (Accept appropriate condensed or stick structures.)

Fermentation involves the conversion of a solution of glucose molecules into ethanol and carbon dioxide in **warm, anaerobic** conditions using **yeast** as a **catalyst**.



5. Chemical structure: *shown above*

Conditions required for fermentation: Yeast to act as a catalyst and room temperature, anaerobic conditions/lack of oxygen.

Fermentation process: Fermentation is a complex enzyme - controlled chemical reaction in which glucose molecules are converted step-by-step into ethanol and carbon dioxide molecules in anaerobic conditions/without oxygen

Equation: $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{CH}_3\text{CH}_2\text{OH} + 2\text{CO}_2$

6. Sugars such as glucose (also fructose and sucrose) are converted into energy, ethanol and carbon dioxide.

Yeasts perform the fermentation process under anaerobic conditions (without oxygen).

Glucose \rightarrow ethanol + carbon dioxide gas + energy

$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + \text{energy}$